Yukon State of the Environment Interim Report 2003

Environmental Indicators

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Introduction

Why produce an interim State of the Environment Report for Yukon?

Interim State of the Environment reporting is a requirement of the Yukon *Environment Act*. The interim report's purpose is to provide an early warning and analysis of potential problems for the environment; allow the public to monitor progress toward the achievement of the objectives of the *Environment Act* and to provide baseline information for environmental planning, assessment and regulation. The focus of this interim report is to provide an update on Climate Change, Air, Water, Land, and Nature.

> ***Environment Act***
> ***Interim Report***
>
> ***50.*** *(1) Commencing from the date of the first Yukon State of the Environment Report, for every period of twelve consecutive months in which a Yukon State of the Environment Report is not made, the Minister shall prepare an interim report and submit it to the Legislative Assembly.*
>
> *(2) An interim report under subsection (1) shall comment on matters contained in the previous Yukon State of the Environment Report.*

This interim SOE Report answers five basic questions:

- What is the issue?
- What are the indicators?
- What is happening?
- Why is it happening?
- Why is it significant?

Indicators are used to answer these questions and demonstrate whether environmental changes are positive or negative.

What is an indicator?

Indicators are key measurements used to monitor, describe and interpret change. Indicators cannot provide all information on a particular topic, but can give key information that shows how things in the environment are doing. The indicators featured here are based on key criteria including data availability, data reliability, usefulness, and ease of understanding.

How was this report developed?

This report represents a collective effort from scientific experts, government agencies, non-governmental organizations and coordinators, who have provided information, data, and advice.

Highlights

Climate Change

Yukon has consistently produced fewer greenhouse gas emissions (GHGs) per capita than Canada. Yukon levels declined about 10 percent between 1990 and 2001. Nevertheless, northern British Columbia/Yukon has experienced the greatest winter warming trend among Canada's 11 climate regions since 1948. These changes have, in turn, affected physical systems that inevitably influence biological systems and their interaction with human activities.

Air

In the City of Whitehorse, mean monthly and annual levels of fine particulate matter ($PM_{2.5}$) comprised of smoke, liquid droplets and dust were well below other jurisdictions in 2002 and 2003. Long-term air quality trends based on annual $PM_{2.5}$ levels cannot be assessed yet as data collection only began in July 2001.

Water

Since assuming responsibility for the Waters Act from the Government of Canada in 2003, Environment Yukon has begun to develop a multi-government water quality monitoring network that will expand the number of Yukon sampling stations, improve data analysis, and increase resource sharing. These actions will help to establish a Yukon Water Quality Index that translates complex technical data into simple descriptors, similar to the UV index.

Land

Land Use and Resource Management Planning

The sustainability of resource use and environmental protection depends on effective land use planning for human activities. The status of six types of land use and resource management planning in Yukon varies from non-existent to current and active. No regional land use plans are in place.

Land Use Quality Index (LUQI)

It is difficult to evaluate the effectiveness of land use planning. A more comprehensive indicator that measures the change in the human "footprint" is being developed. It will examine wilderness fragmentation, changes in human settlement and land tenure.

City of Whitehorse Solid Waste Management

The total amount of waste going to the City of Whitehorse landfill is still increasing, but a higher percentage is being recycled and composted. Household curbside collected waste has decreased by 36 percent between 2001 and 2003.

Nature

Contaminants

Contaminants from a variety of local and global sources can enter the Yukon environment and can become concentrated along the food chain, causing serious health implications for wildlife and people. Studies of Yukon wildlife suggest that while levels of many contaminants have decreased the levels of other contaminants, such as lead, are much higher than in the past.

Species at Risk

Conservation Status Ranks developed by NatureServe, an international network of some 90 conservation data centres throughout the Americas, will be used as a future indicator of Yukon's species at risk and, by extension, its biodiversity. Since 2001, NatureServe Yukon has been collecting and refining baseline data that will allow it to rank species, subspecies, varieties and ecological communities according to the system.

Ecosystems: Wetlands

Ongoing inventory work and conservation planning is securing Yukon's relatively scarce, but highly valuable wetland areas for the future. Currently, 52 wetlands are formally recognized as important. Three have been protected and another eight will likely be protected after the conclusion of land claims agreements.

Wildlife – Interesting Stories for 2003

- Northern Pike mysteriously disappear from Watson Lake.
- The Chisana Caribou innovative captive breeding project is an early success.
- Yukon Birders launch a big Yukon bird book.

1. Climate Change

1.1 Climate Change Drivers–Greenhouse Gas Emissions

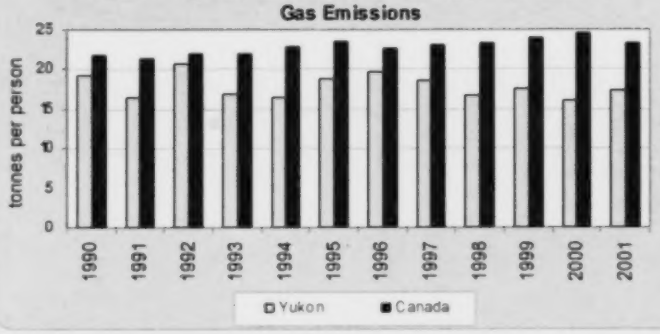
What is the issue?

Globally and regionally, climate systems are changing. Most scientists believe these changes are primarily a response to a build-up of human-produced greenhouse gas emissions (GHGs) that trap heat in the atmosphere. Fossil fuel consumption is a major source of human-caused GHGs.

What are the indicators?

1. Yukon per capita (per person) GHGs compared with Canada (Figure 1.1.1).
2. Percentage of GHGs per sector compared with Canada (Figure 1.1.2).

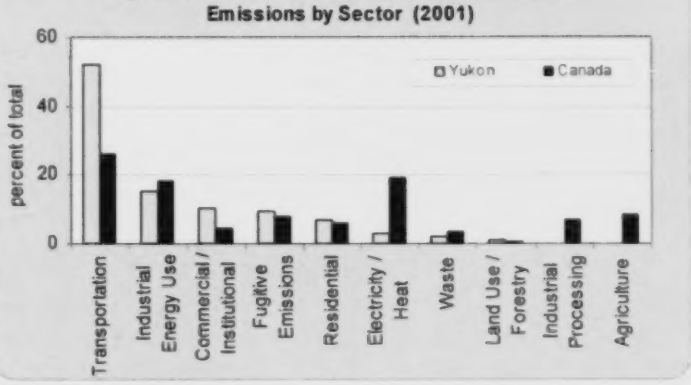
Figure 1.1.1 Canada and Yukon Per Capita Greenhouse Gas Emissions



What is happening?

1. Since 1990, Yukon has consistently produced fewer GHGs per capita than Canada. In 2001, Yukon's total emissions were 14 percent below 1990 emissions.
2. GHGs in Yukon, as in Canada, are highest in the transportation sector. However, Yukon emissions in this sector account for 52 percent compared to 26 percent for Canada. Electricity, industry and agriculture produce a much smaller share of Yukon's total emissions compared to Canada.

Figure 1.1.2 Canada and Yukon Greenhouse Gas Emissions by Sector (2001)



Why is it happening?

Fluctuations in Yukon's total and per capita emissions reflect resource sector activity, most notably in mining and, more specifically, energy production for the Faro mine. High transportation emissions result from large distances between population centres, operating inefficiencies related to the northern climate, and the absence of economies of scale.

Why is it significant?

Climate Change is a global, national, regional, local and individual issue. Canada is among the highest per capita emitters of GHGs in the world. The ratification of the Kyoto Accord has committed Canada to reducing GHG emissions to six percent below 1990 levels by 2008 to 2012.

Taking Action in 2003

Various organizations have promoted innovative and active ways – like using fossil fuel alternatives and cycling to work – for people to help reduce greenhouse gases. Some 2003 highlights include:

- Governments, non-governmental organizations (NGOs), businesses and individuals joined forces to reduce GHGs and raise awareness of climate change by using active and sustainable forms of transportation during Environment Week's Commuter Challenge.
- The City of Whitehorse initiated *The Whitehorse Driving Diet Program*, an integrated approach for reducing greenhouse gases from the transportation sector (http://www.city.whitehorse.yk.ca).

Data Quality

All data is collected and assessed by Environment Canada for Canada's Greenhouse Gas Inventory, 1990-2002. Data and assessment are becoming more accurate over time. The Yukon Government has a different method of calculating fugitive emissions from the Kotaneelee gas plant and believes actual emissions are about 1/10 that of Environment Canada's calculation.

1.2 Primary Indicators of a Changing Climate

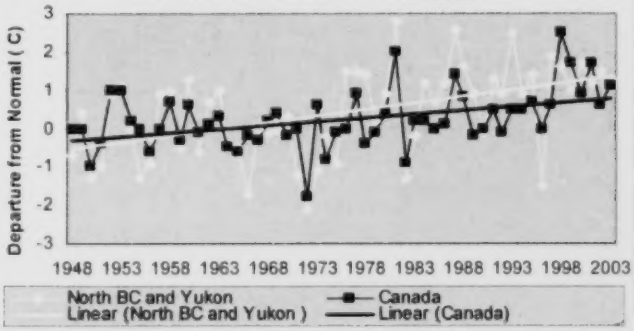
What is the Issue?

The primary effect of heat trapped in the atmosphere is temperature change at the earth's surface. The study of this change and the resulting physical, biological and human health consequences have spurred new areas of complex, integrated research and science.

What are the Indicators?

1. Departure from normal (the average) annual temperature for Northern British Columbia (B.C.)/Yukon and Canada during the Period 1948-2003 (Figure 1.2.1).

Figure 1.2.1 Annual Temperature Departure from Normal in the period 1948-2003 for Northern BC / Yukon and Canada

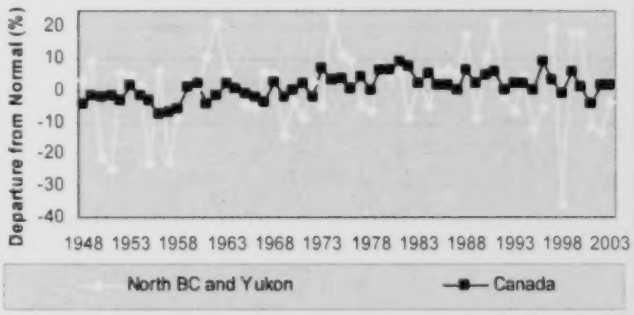


2. Departure from normal (the average) annual precipitation for Northern B.C./Yukon and Canada during the Period 1948-2003 (Figure 1.2.2).

What is Happening?

1. The annual temperature in Northern B.C./ Yukon has increased on average 1.9 °C since 1948, compared to 1.1 °C for Canada. In the winter (December to February), the region has experienced an average 4.4 °C increase – the greatest warming trend among Canada's 11 climate regions. In the Northern B.C./Yukon region, five of the warmest years have occurred in the last decade and 10 of the warmest have occurred since 1976. In Canada, the 10 warmest years since 1860 have occurred in the past 15 years.

Figure 1.2.2 Annual Precipitation Departure from Normal in the period 1948-2003 for Northern BC / Yukon and Canada



2. Since 1948, and especially since 1970, precipitation has increased across Canada. Annual conditions in the Northern B.C./Yukon climate region are highly variable, but normal precipitation levels are generally much lower than in southern Canada. A weighted running mean is used to analyze precipitation trends instead of a linear analysis so trend lines, as used in Figure 1.2.2, cannot be applied.

Traditional Knowledge -

"The traditional knowledge that Aboriginal people relied on in the past to live off the land is becoming harder to apply as a result of more variable weather and changes in the timing of seasonal phenomena. A short, less reliable ice season has also made winter travel, hunting and fishing in the North more difficult and dangerous."

From Highlights of Climate, Nature, People: Indicators of Canada's Changing Climate, CCME.

"In modern times, elders ... remark that temperatures have changed drastically during their lifetime,..."

From The Northern Climate ExChange Gap Analysis Project: *An Assessment of Yukon First Nations Traditional and Local Knowledge and Perspectives on the Impact of Climate Change within the Yukon territory and Northern British Columbia* by LegendSeekers, 2000 <http://yukon.taiga.net/knowledge/gap/legends.pdf>.

Why is it Happening?

The limited period of record probably reflects both natural climate variability and climate change arising from elevated levels of human-induced greenhouse gas emissions. Higher temperature extremes in Yukon and across the north have complex causes that are the subjects of climate change science.

Why is it Significant?

Temperature change affects other parts of the climate system including precipitation, evaporation, snow pack, annual climate variability and severe weather events. In turn, these changes can affect physical systems such as watershed hydrology, and water and soil temperatures. These effects are eventually transmitted to biological systems like caribou and salmon migration and survival, as well as to human health.

Most experts agree that global temperatures could rise by 1.4 to 5.8 °C over the next century. The fact that the annual warming trend in Yukon is more than three times the global average – and much higher in the winter – is cause for concern.

Taking Action in 2003

The Northern Climate ExChange continued to provide the latest climate change news with a focus on Yukon and other northern regions through its website (http://www.taiga.net/nce/). Yukon climate monthly reviews are provided on its website (http://yukon.taiga.net/knowledge/resources.html). Tools like these encourage individuals to increase their awareness and understanding of climate change, take steps to reduce their own GHGs, and support policies that advance sustainable development.

Data Quality

Temperature and precipitation data is collected at weather stations located in Yukon and Northern B.C. by regional offices of Environment Canada. The Climate Research Branch provides raw data and analysis through the newly established *Climate Trends and Variation Bulletin (CTVB)* on the web <http://www.msc-smc.ec.gc.ca/ccrm/bulletin/national_e.cfm>. The earliest year for which reliable inter-regional comparisons are feasible is 1948.

1.3 Examples of Environmental Impacts

What is the Issue?

A changing climate inevitably affects physical systems that, in turn, influence biological systems and their interaction with human activities. In general, changes to the climate system are most directly and obviously reflected in changes to physical systems. However, changes to biological systems can also provide indicators of how climate change is affecting our world. Northern and Arctic environments are particularly vulnerable to the impacts of temperature change, especially where the survival of traditional lifestyles is concerned.

Traditional Knowledge -

Fort McPherson (N.W.T.) Interviews:

> *"Everyone expressed concerns about the fast melting of our permafrost."*
> *"We are getting a lot of landslides, cut banks and erosions all over the delta and the river. There are also landslides up on the foothills."*
> *"One elder reported that the ground around the lakeshores is melting. She's never seen this happen in her life."*

Old Crow Interviews:

> *"This year freeze-up was very slow because of the warm weather and as a result it was difficult to travel on the river and lakes."*
> *"People did not do any ice fishing until late October because of thin ice."*
> *"Hunting, fishing, trapping and hauling wood were difficult and rough because there was no snow. It was hard on snow machines."*

From Arctic Borderlands Ecological Knowledge Co-op Community Reports 2002/03 <http://www.taiga.net/coop/community/2002-03/2002-03Community.pdf>.

> *"Many Yukon First Nation legends refer to time periods when the environment is unlike it is today. The great flooding, which so many legends refer to, correlates to glacial melting in the Yukon."*

From The Northern Climate ExChange Gap Analysis Project. *An Assessment of Yukon First Nations Traditional and Local Knowledge and Perspectives on the Impact of Climate Change within the Yukon territory and Northern British Columbia* by LegendSeekers, 2000.

Overview of a Few Climate-related Impacts and Yukon-based Studies of Interest in 2003

A wide variety of research related to climate change is being carried out in Canada's North, including Yukon. A few interesting highlights from 2003 are summarized below:

Spruce Bark Beetle Infestation in the Kluane Region

The 2003 Forest Health Survey, prepared cooperatively by the Canadian Forest Service and Yukon Forest Management Branch, suggests that "a largely healthy population of beetles" was continuing to kill remaining trees in infested areas and moving into new areas.

Furthermore, a 2003 study, included in the "The Kluane Ecological Field Monitoring Project Annual Report-2003" by Berg and Henry, concludes that "weather patterns likely have intensified the spruce bark beetle infestation in the Kluane region in several important ways." Their findings include:

- An unbroken run of warmer than normal summers from 1989 to 1995 likely promoted greater beetle reproduction through enhanced larvae survival and early pupation;
- Warmer temperatures in early to mid-December, combined with the absence of severe cold periods, have probably reduced over-wintering beetle mortality; and
- Increased moisture stress – the result of a net decrease in summer precipitation from 1986 to 1995 (Garbutt 2003) – may have reduced the ability of the trees to get rid of beetles through a "pitching out" process.

Arendt et al.'s 2002 study, *Rapid Wastage of Glaciers in the Yukon and Alaska and Rising Sea Level*, based on laser altimetry estimates and measurements, suggests that the average annual rate of thickness change in glaciers in Alaska, southwestern Yukon and northwestern B.C. was more than three times higher between the mid-1990s and 2001 than it was from the mid-1950s to the mid-1990s (1.8m/year versus 0.52m/year). When extrapolated to all glaciers in Alaska, this rate of thinning equates to a sea level rise of 0.27+/- 0.10 mm/year. The study's findings have fuelled considerable discussion into 2003 about the contribution of mountainous glacier meltwater to sea level rise and the effects of climate change.

Permafrost and Landslide Activity and Climate Change

In the summer of 2003, the Yukon Geological Survey studied a number of recent landslides along the Alaska Highway in the southwestern Yukon, in part to examine "the role of permafrost in landslide processes... and address the potential influence of climate change on these processes." The study's findings suggest that any climate change leading to increased frequency and/or magnitude of river migration, intense summer rainfall, rapid snowmelt or permafrost degradation (such as that caused by forest fires) should similarly increase the frequency and/or magnitude of periglacial landslides. The study also demonstrated the "delicate existence" that permafrost has within the current climate regime.

Taking Action in 2003

Environment Canada used its "Your Yukon" illustrated column, published every Friday in the *Yukon News*, to raise public awareness about environmental issues and research, including climate change.

The hydrology section of the Yukon Government's Water Resources Branch continued to conduct snow surveys, provide flow forecasting through a series of public bulletins, monitor lake and flow levels, and provide advice and predictions to industry. Ongoing studies at the Wolf Creek Research Basin helped northern flood forecasters calibrate computer models to northern conditions.

The Northern Climate ExChange published three issues of its newsletter *Weathering Change*.

Yukon's office of C-CIARN (Canadian Impacts and Adaptation Research Network) North:

- Hosted two online climate change workshops on infrastructure and resource development;
- Carried out the Yukon Research Needs Survey to help identify what research is needed to help us all make informed decisions in the light of a changing climate; and
- Completed a preliminary Yukon Climate Change Research Compendium.

2. Air

2.1 City of Whitehorse Air Quality

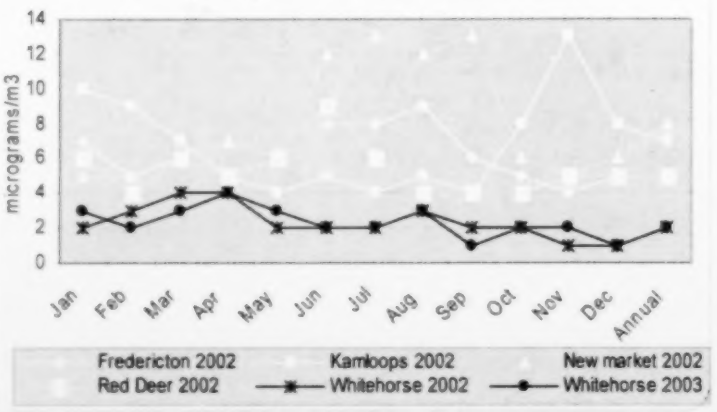
What is the Issue?

Poor air quality related to emissions from activities like fossil fuel consumption, combined with local climate, geography and specific events such as forest fires, can negatively affect human and environmental health.

What are the Indicators?

Fine Particulate Matter ($PM_{2.5}$), comprised of pollutants in the form of smoke, liquid droplets or dust smaller than 2.5 micrometers in diameter, is a toxic substance that can be inhaled deeply into the lungs. The levels of this pollutant provide a good indicator of air quality. Levels above this standard may cause a health hazard. Specific indicators are:

Figure 2.1.1 Monthly and Annual Means of Particulate Matter (PM2.5) in Whitehorse and Selected Cities



1. Mean Ambient Annual $PM_{2.5}$ levels in the City of Whitehorse (Figure 2.1.1).
2. Mean monthly and annual $PM_{2.5}$ levels compared with other relevant jurisdictions (Figure 2.1.1).
3. Number of days per year that $PM_{2.5}$ levels (24-hour average) exceeds the Canada-wide standard of 30 micrograms/m^3 (levels above this pose a human health risk).

What is Happening?

1. Long term air quality trends based on annual $PM_{2.5}$ levels cannot yet be assessed as data collection only began in July 2001.

2. In 2002 and 2003, mean monthly and annual $PM_{2.5}$ levels in the City of Whitehorse were well below other jurisdictions. Average $PM_{2.5}$ levels in the City of Whitehorse tend to be higher in the spring.

Why is it Happening?

City of Whitehorse's air quality tends to be good because of its limited industrial emissions and its relatively low population density. Elevated $PM_{2.5}$ levels often occur as a result of wood smoke from woodstoves or forest fires, from backyard burning and barbeques, from improperly burned fuels for heating or vehicles, and from road dust, particularly in the spring.

Why is it Significant?

When breathed, fine particulate matter in the air may pose serious risks to human health, especially among the elderly, children and people with chronic respiratory illnesses.

Taking Action in 2003

In 2003, the City of Whitehorse developed *The Whitehorse Driving Diet Program* that includes Transportation Demand Management and driver behaviour change strategies and educational initiatives. Transportation emission reduction is a program goal.

The *Clear the Air* campaign continued in 2003. It is a joint educational program between the City of Whitehorse and Environment Yukon. The program focuses on the health and environmental effects of wood smoke and vehicle exhaust with a goal of improved air quality when people use their woodstoves and vehicles.

Data Quality

The National Air Pollution Surveillance (NAPS) data is quality controlled, assured and standardized by Environment Canada. The 2003 NAPS data is preliminary. Data from the NAPS station, located in downtown City of Whitehorse (1011 – 1st Avenue) is not representative of air quality Yukon-wide.

3. Water

3.1 Water Quality Index (Indicator under Development)

What is the Issue?

Yukon's water bodies and watersheds must be publicly monitored in order for decision-makers to take appropriate actions to safeguard water quality. The Water Quality Index (WQI) provides an effective way to compile and communicate important information about the state of water quality, as well as to identify emerging trends.

What will the Future Indicator Measure?

Developing a WQI

Similar to the UV index, a WQI reduces technical data about the quality of a water body to a rating on a numerical scale where defined ranges correspond to simple, easy-to-report descriptors, for example, Poor, Good or Excellent. Depending on the chosen type of data, an index can evaluate the suitability of a water body for various human uses – drinking, swimming, fishing and irrigation, for example – or for interrelated use by fish, wildlife or livestock. The B.C. WQI, for example, considers six water uses: drinking, recreation, irrigation, livestock watering, aquatic life and wildlife.

The parameters for a particular WQI must consider the natural quality of the water body and, given the nature of the use, the safe limits of contaminants that might potentially enter the water due to factors such as local geology, community runoff, wastewater effluent or water diversions. Safe limits are set using national or regional water quality guidelines or site-specific water quality objectives. When monitoring determines that the safe limits are being met at all times, the WQI rating will be close to zero indicating excellent water quality.

The index is dependent on the choice of contaminants and properties to measure, for example, pH, turbidity, metals, and biological parameters. Naturally, people are more likely to trust the WQI when the main users have been involved in the selection of the water uses, quality objectives and properties to be measured.

WQI in Yukon

Three locations were considered in the establishment of Yukon's first WQI: the Yukon River at the City of Whitehorse, the Klondike River at Dawson City, and the South McQuesten River. The City of Whitehorse location was chosen because it scored high on the criteria for data consistency, data frequency and local watershed concerns. The City of Whitehorse also has a draft Watershed Management Plan that the WQI can be designed to support. A WQI at the City of

Whitehorse location is now in its early stages of development. Properties may include metals, turbidity and biological parameters, but will be determined with the input of key users.

WQIs were investigated for the Peel and Liard River Sub-basins (both with headwaters in Yukon) as part of the *Mackenzie River Basin State of the Aquatic Ecosystem Report 2003*. Favourable assessments were given for both basins; however as a result of natural conditions and processes there were high sediment loads in certain locations at different times of the year and high levels of certain metals in the Peel Basin. These conditions could reduce the allowable levels of wastewater discharge in these watersheds, thereby affecting any proposed resource developments in the regions.

Taking Action in 2003

On April 1, 2003, responsibility for water management under the *Waters Act* (Yukon) was transferred from Canada to the Yukon Government.

Environment Yukon initiated the development of a multi-government water quality monitoring network that will expand the number of Yukon sampling stations, improve data analysis, and increase resource sharing. This will provide a stronger basis for establishing a WQI for Yukon.

The US Geological Survey (USGS) initiated a comprehensive, multiyear study of the Yukon River Basin designed, among other things, to develop baseline water quality conditions and identify source areas of potential contaminants.

4. Land

4.1 Land Use and Resource Management Planning

What is the Issue?

The sustainability of resource use and development depends on effective planning for future human activities and environmental protection. Plans related to land use, resources and protected areas generally include an inventory of values, resources and interests; a set of goals and objectives; and strategies intended to achieve these objectives.

What are the Indicators?

The status of Management Plans for:

a) Regional Land Use Plans (RLUPs);

b) Official Community Plans (OCPs);

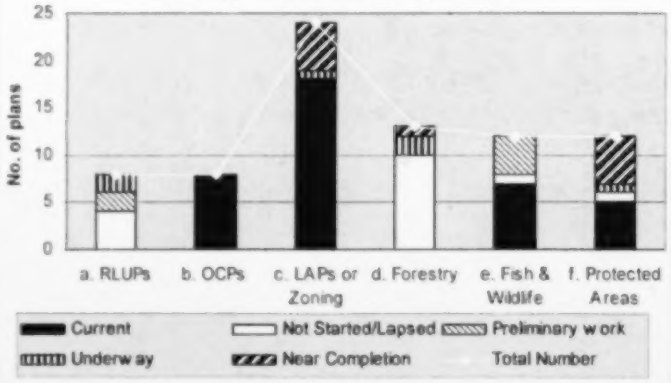
c) Local Area Plans (LAPs) or Area Zoning Regulations;

d) Forestry Management Plans;

e) Fish and Wildlife Species or Area Plans; and

f) Protected Area Plans.

Figure 4.1.1 2003 Status of Land Use and Resource Management Plans in the Yukon



The plans are divided into five progress categories, as shown in Figure 4.1.1.

What is Happening – and – Why is it Happening?

1. No RLUPs have been completed in Yukon. Planning for Dakh Ka-Teslin and North Yukon were underway in 2003. In order to move forward with regional land use planning, all governments must reach agreement.

2. All eight Yukon municipalities have completed OCPs, as required under the Municipal Act.

3. Residents or governments initiate Community or LAPs, often to address conflicts or potential conflicts. The plans can be regulated through zoning bylaws or under the Municipal Act. Over time, the number of LAPs outside of municipal boundaries is increasing as community residents become less transient.

4. In 2003, management plans were underway for two of Yukon's 13 forest management units. A draft plan was completed for the traditional territory of the Champagne and Aishihik First Nations. More Forest Plans will be developed as devolution is fully implemented.

5. By the end of 2003, five area or species specific Fish and Wildlife Plans were current, three plans were in early stages of development, and two have expired. Fish and Wildlife Plans will likely grow in number as more land claims are settled. They are the most practical way to effectively implement Chapter 16 of First Nation Final Agreements, which require management coordination.

6. Protected areas include Habitat Protection Areas (HPAs), and territorial and national parks – most of which were created as Special Management Areas (SMAs) through First Nation Final Agreements. Five protected areas have current management plans. Five areas have plans near completion. One area has a plan underway. Herschel Island and the Coal River Ecological Reserve have plans which are due for review. It takes time to develop plans and they must be renewed to ensure their effectiveness. A number of new protected areas have been created in the last few years.

Why is it Significant?

The development of long-term plans through responsive public processes is a proactive way to manage competing views about how lands and natural resources within Yukon's regions should be used. Regional planning needs to reflect the traditional knowledge, experience and recommendations of residents as well as science and broad socio-economic and environmental aspects. This ensures that governments and First Nations authorize uses that are consistent with social, cultural, economic and environmental values, including sustainable development. The role of planning has become all the more important as a result of obligations arising from Yukon land claims agreements.

Taking Action in 2003

In addition to the planning initiatives identified above, the City of Whitehorse released a draft Watershed Management Plan in late 2003, the first of its kind in Yukon.

4.2 Land Use Quality Index (Indicator under Development)

What is the Issue?

It is relatively easy to measure the level of land-based planning in Yukon; it is more difficult to evaluate the success of the resulting plans. Decision-makers would benefit from a comprehensive indicator that measures success related to several variables, including how efficiently Yukoners use land, reduce their collective "footprint," and minimize negative impacts on wilderness areas.

What will a Future Indicator Measure?

A comprehensive Land Use Quality Index (LUQI) could measure the human impact on Yukon land by examining annual changes in the human "footprint" relative to population. Although a great deal of work is still required, an improved regulatory regime and new data management plans under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) could facilitate the future development of an index that could include the following components:

1. **Wilderness fragmentation**, which considers the density of transportation corridors (roads, trails, pipelines, etc.) and road kills in each eco-region; the use of new closely parallel or unnecessary corridors;
2. **Human settlement change**, as revealed by settlement patterns over time; and
3. **Changes in land tenure and land use policies/practices**, as suggested by the number and location of land use and resource permits.

What is Happening – and – Why is it Happening?

1. New transportation corridors provide human access to wilderness areas, and also create "linear disturbance" that fragments habitat and can prevent wildlife from fully using it. The number of road kills provides an indication of direct impacts on wildlife.
2. Human settlement patterns in Yukon are similar to those in the rest of Canada where populations are heavily concentrated in cities and along transportation corridors and hazardous flood plains.
3. The settlement of First Nation land claims and devolution of land management responsibilities to the Yukon Government could increase land disposition for resource development and new settlements. Demand may necessitate appropriate modifications to policies and practices related to land tenure and land use planning.
4. Yukon is a global hot spot for climate change. Because of this, it may be necessary to give greater attention to climate change in order to avoid and/or mitigate any negative impacts on the Yukon environment.
5. Change in the number and location of protected areas over time is an important measure.

Why is it Significant?

The development of transportation corridors in wilderness areas has direct effects in the form of road kills, habitat damage and linear disturbances. Indirectly, this development can then affect the behaviour of wildlife and related harvesting activities by humans. Increased access to wilderness areas for industry also has cumulative socio-economic impacts on Yukon. Flood plains may be more valuable as wetland habitat than as residential or industrial land.

At present, Yukon's maximum road density by eco-region in the south is 0.06 km/km^2 although road densities within some parts of eco-regions, such as the Dawson City and the City of Whitehorse areas, are much higher. The B.C. State of Environment suggests that negative effects can be seen if the following road densities are exceeded: for grizzlies, 0.4 km/km2; for black bears, 1.25 km/km^2; and, for elk, 0.62 km/km^2. While road densities in Yukon are lower, there is still a negative impact on wildlife.

Changes in land tenure, as noted above, require a sensitive measure as well under future indicators.

Taking Action in 2003

The Yukon Fish and Wildlife Management Board published *Down the Road: The Effects of Road and Trails on Wildlife* to raise public awareness about the impacts of wilderness access, explain how public policy can reduce these impacts, and suggest ways that individuals can help protect sensitive landscapes.

4.3 City of Whitehorse Solid Waste Management

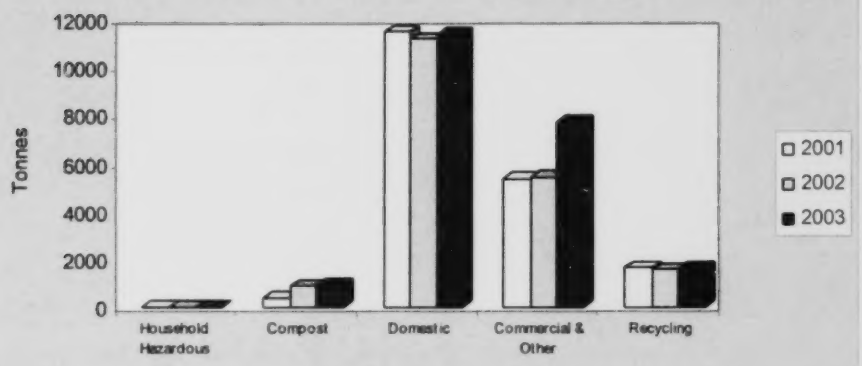
What is the Issue?

Solid waste produced in Yukon is costly to manage, whether it is sent to landfills, diverted through recycling or composting, or shipped outside for treatment. Solid waste disposal to local landfills can also pose serious environmental and health risks, as well as land use planning challenges. The best way to limit the negative effects of solid waste is to reduce the reliance on landfills by generating less waste and recycling or composting more of the remaining waste stream.

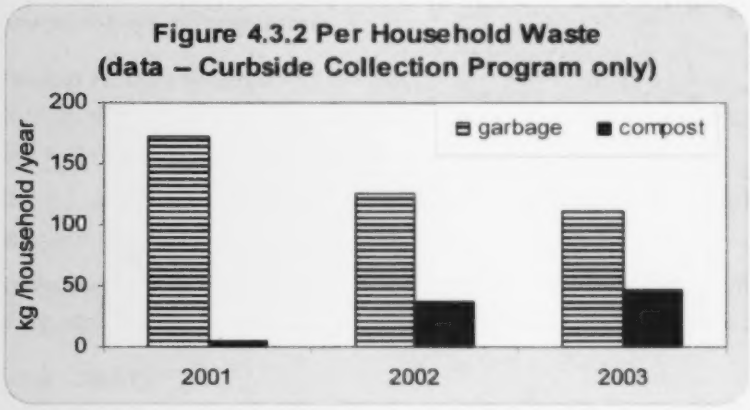
What are the Indicators?

1. Total annual tonnage of waste (Figure 4.3.1) arriving at the City of Whitehorse Son of War Eagle Landfill and Raven Recycling Depot.

Figure 4.3.1 Solid Waste Disposal, Recycling and Composting in Whitehorse (Data Raven Recycling Depot & Landfill)



2. Garbage[1] and compostables per household (Figure 4.3.2) based on curbside collection for 4,950 City of Whitehorse households.



What is Happening?

1. The total amount of waste going to the landfill is still increasing, but a higher percentage of waste is being recycled and composted. Collection of household hazardous waste has increased from 2.0 to 8.5 tonnes between 2001 and 2003 (Figure 4.3.1).

2. Curbside household waste collected has decreased from 173 tonnes in 2001 to 111 tonnes in 2003, a 36 percent reduction, while compost collection has increased (Figure 4.3.2).

Why is it Happening?

1. Commercial waste remains high likely because there are few recycling opportunities for construction waste. Domestic waste remains high due to a lack of participation in composting and recycling. In contrast, the volume of household hazardous waste (HHW) has risen because of improved awareness of its dangers and additional collection days.

2. The amount of waste that each City of Whitehorse household sends to the landfill has declined due to the City of Whitehorse limiting the number of bags to 4 for curbside garbage collection as well as instituting the curbside collection of compost, increased public awareness of alternatives, and options for local recycling.

[1] Garbage means all items that cannot be composted or recycled, and that are not hazardous.

Why is it Significant?

Waste generation can negatively affect the quality of land, air and water, especially when it results in disposal to landfills. Individuals can mitigate these impacts by reducing, reusing and recycling their waste as much as possible. At the same time, recycling has the potential to generate income and employment.

Taking Action in 2003

The City of Whitehorse continued its citywide curbside compost collection program, which has a goal to divert at least 50 percent of solid waste from the landfill site.

The Yukon Government and City of Whitehorse collaborated to hold three hazardous waste collection days annually.

Raven Recycling Society continued its PaperSave program that offers a collection service for office paper and cardboard on an "as-needed" or regularly scheduled basis.

Data Quality

Three years of data does not yet provide for solid trends. The City of Whitehorse is improving its waste stream tracking methods. It has good curbside waste data. Commercial, construction and domestic waste streams are more challenging to track.

Data is for the City of Whitehorse area only and does not represent what is happening in the communities. Community solid waste data is not available on a regular, consistent basis.

5. Nature

5.1 Contaminants in the Environment

What is the Issue?

Heavy metals, persistent organic pollutants (POPs) and radionuclides are contaminants that can persist in the environment. These contaminants can become concentrated along the food chain through bioaccumulation and biomagnification causing serious health implications for wildlife as well as people – especially those who depend on traditional foods. Many contaminants found in the north have never been used in the region or, in some cases, have been banned or restricted for many years. Transported here by wind and water, they tend to settle out in colder climates.

What are the Indicators?

1. **Lead levels in Yukon caribou**
   The levels of lead stored in the teeth of road-killed caribou were compared to the levels found in fossilized jaws of caribou that ranged in the same area between 6,000 and 360 years ago.

2. **POP concentrations in lake trout and burbot**
   Between 1993 and 2003, a study examined organochlorine (OC) concentrations in lake trout and burbot from Lake Laberge, Kusawa Lake and Quiet Lake. The lake studies also looked at mercury in fish.

3. **Cadmium levels in Yukon caribou and moose**
   Through the volunteer hunter donor program, the Yukon Contaminants Committee and Environment Yukon annually collect livers, kidneys and muscle samples from moose and caribou for contaminant analysis. Cadmium was also measured in caribou teeth.

What is Happening?

1. There has been a four to fivefold increase in lead levels in modern Yukon caribou compared with fossilized caribou. The teeth from the Aishihik caribou herd have been analyzed and show the same pattern for lead as the Southern Lakes caribou herd.

2. There is strong evidence that OCs are decreasing to varying degrees in all three lakes. No consistent trends were observed in OC concentrations in burbot.

3. After ten years of testing, the Northern Contaminants Program has concluded that cadmium levels are stable and do not appear to be changing. Cadmium concentrations tend to be higher in Yukon moose than barren land caribou, and are variable in woodland caribou due to diet. The teeth from the Aishihik caribou herd have been analyzed and show the same pattern for cadmium as the Southern Lakes caribou herd.

Traditional Knowledge -

"To us, persistent organic pollutants (POPs), heavy metals and radioactivity in traditional country food are not just an environmental or pubic health issue but raises questions of our cultural survival."

From a Statement prepared by the Aboriginal Partners of the Northern Contaminants Program.

"Northern Aboriginal peoples recognize the ways in which western science can help with concerns about contaminants. Conversely, research scientists recognize the value of the knowledge of local people, which gives them a perspective on wildlife and environmental systems that can assist in scientific research."

From the Canadian Arctic Contaminants Assessment Report (CACAR) Phase II report.

Why is it Happening?

1. Caribou feed on lichen that can directly absorb atmospheric contaminants, including lead, whose levels in northern ecosystems are greater today than they were in pre-industrial times. The isotopic signature of the lead in modern caribou reveals its source as North American leaded gas, which Canada officially banned in 1990.

2. The suspected factors affecting contaminant concentrations in burbot and trout are primarily biotic ones, such as fish lipid content and body mass changes caused by fish population variations or lake plankton productivity. Atmospheric levels of some OCs seem to have decreased in the north.

3. Cadmium is present in Yukon's underlying geology, especially in the southeast region, so the relatively high concentrations found in moose and caribou are more likely the result of local sources rather than global transportation. Moose freed primarily on willows, which are hyperaccumulators of cadmium, whereas the diet of woodland caribou also includes lichen, which has no root system to allow the absorption of local cadmium through the soil. This is likely due to the shift in vegetation away from grass and willow after the ice left to the climax boreal forest system Yukon now has. The results of the feacal study to look at diet will confirm this supposition. Barren ground caribou feed almost exclusively on lichen, so their cadmium levels tend to be lower.

Why is it Significant?

1. The transport patterns, persistence and extent of lead in Yukon's ecosystems can be studied further based on these early findings. Fortunately, the amount of lead in modern caribou – a

traditional food source for many Yukon First Nations people – is not beyond health limits, nor does the metal bioaccumulate along the food chain.

2. In order to assess OC contaminant levels in fish and overall ecosystem health, biotic factors must be considered along with atmospheric OC levels and geography.

3. Because the high levels of cadmium in our moose and caribou are coming from naturally occurring sources, the only course of action is to be aware of the issue as a potential health concern. Because ingesting too much cadmium can be harmful, Health Canada has recommended limiting the intake of Yukon moose and caribou liver and kidney. The recommendation for moose is one liver and kidney per year, and the recommendation for caribou ranges from seven to 32 kidneys and four to 16 livers depending on the herd.

Taking Action in 2003

In 2003, ancient caribou jaws and other artifacts were collected through the Yukon Ice Patch Research Project from a broader geographical range, including ice patches in the Ruby Range, Aishihik and Carcross. These will be carbon-dated and analyzed for heavy metals in the near future.

The Indian and Northern Affairs Canada (INAC) - Northern Contaminants Program guides and funds contaminants research and monitoring in the Canadian Arctic. The program has prompted a wide range of contaminant studies and is a storehouse of contaminant data and information. In 2003, the program began monitoring the following "emerging contaminants" in Yukon's lake trout and burbot: Polybrominated Diphenyl Ethers, (for example, flame-retardants) and Perfluorooctane Sulfonate, (for example, waterproofing compounds). The program has also committed to monitoring contaminants in the Porcupine caribou herd, and lake trout in Lake Laberge and Kusawa Lake on an annual basis, and in moose and one Yukon woodland caribou herd every five years.

5.2 Species at Risk (Indicator under Development)

What is the Issue?

While species extinction can be a natural process, the variety of earth's animal and plant life is threatened when rates of extinction and the number of endangered species increase too much. The protection of species at risk and the reduction of alarming extinction rates – estimated by some biologists at 100 species a day – require different mechanisms at the local, regional, national and global levels. Since, for example, a species may be locally healthy but globally at risk, coordinated action is also necessary to preserve biodiversity. Currently, a major threat to species at risk, including some that live in Yukon, is habitat loss through modification or outright destruction by human activities.

What are the Future Indicators?

The number of species at risk is used as an indicator of the status of global biodiversity. It can also be used to measure biodiversity on a smaller scale. There are many potential ways to categorize and measure Yukon's species at risk. In future, the Conservation Status Ranks developed by NatureServe will be used for this purpose since they focus on Yukon data that is comparable from year to year. The system ranks species, subspecies, varieties and ecological communities on a scale from 1 (Critically Imperiled) to 5 (Secure) and puts risk levels in geographic context by incorporating global, national and provincial/territorial status ranks.

What is NatureServe?

Formally established in 2001 as a permanent partnership between the Canadian Wildlife Service, Environment Yukon and non-governmental interests, NatureServe Yukon belongs to an international network of some 90 conservation data centres throughout the Americas. It tracks the status and location of species and ecological communities, especially those at risk, so that the information can be used for conservation and development planning.

5.2.1 NatureServe Global Conservation Status Ranks

X	**Presumed Extinct** – Not located despite intensive searches, virtually no likelihood of rediscovery.
H	**Possibly Extinct** – Known from only historical occurrences, but still hope of rediscovery.
1	**Critically Imperiled** – At very high risk of extinction due to extreme rarity (often five or fewer populations), steep declines, or other factors.
2	**Imperiled** – At high risk of extinction due to very restricted range, few populations (often 20 or fewer), steep declines, or other factors.
3	**Vulnerable** – At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
4	**Apparently Secure** – Uncommon, but not rare; some cause for long-term concern, for example, widespread declines.
5	**Secure** – Common; widespread and abundant.

What is Happening with NatureServe Yukon?

Still in its early stages, NatureServe Yukon's focus is on collecting accurate baseline data to address some critical gaps. Good data exists for caribou, peregrine falcons and vascular plants. Definitive lists of Yukon's vascular plants, vertebrates, dragonflies and butterflies have been created, and all species have been assigned conservation ranks using NatureServe methodology.

Other Mechanisms for Identifying and Managing Species at Risk

Other possible mechanisms that could be – and have been – used for identifying and managing Yukon species at risk include the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Convention on International Trade in Endangered Species (CITES), the Yukon *Wildlife Act*, and wildlife status reports prepared every five years using Yukon-generated baseline data. In addition, in June 2003, the federal *Species at Risk Act* (SARA) came into effect. SARA was created to protect wildlife species from becoming extinct. Depending on which mechanism is used, there are between eight and 13 species at risk in Yukon.

5.3 Ecosystems: Wetlands

What is the Issue?

Bogs, fens, swamps, marshes and shallow open water areas – collectively categorized as wetlands – are productive ecosystems that cover only three percent of Yukon's land base. While small wetlands are scattered throughout the territory, the largest are concentrated in low-lying permafrost terrain north of the Arctic Circle. Due to their limited scope and isolated locations, these relatively scarce habitats do not generally face the same immediate risks from human development that wetlands in other jurisdictions do. However, because of their scarcity, they are even more important and in need of planning to anticipate any resource development. Ducks Unlimited Canada, for one, is optimistic that important wetland areas can be conserved with timely, and proper planning.

What are the Indicators?

1. The number of wetlands inventoried and designated as critical, sensitive or important depending on habitat values, especially for migratory birds.
2. The conservation status of designated wetlands, as determined by protection under a SMA such as a national wildlife area, national or territorial park, or HPA.

What is Happening?

1. Although few Yukon wetlands have been systematically studied, 52 have been recognized as important by the Yukon Wetland Technical Committee, based mostly on their value as habitat for migratory birds, including some that are rare or of restricted distribution in Yukon. The majority of important wetlands have been registered as special habitat notations on Federal-Territorial Resource Maps. However, this does not accord these wetlands – including four identified by Ducks Unlimited Canada as "at risk" – any legal protection. Wetland inventory is ongoing.
2. As a result of land claims agreements, two of Yukon's most important wetlands – the Old Crow Flats and North Slope Wetlands – have been protected in Vuntut National Park and Ivvavik National Park. Three more wetland areas are or will be designated as HPAs, and another five will likely be nominated as SMAs when other land claim agreements are concluded. Assuming this occurs, more than half of Yukon's total wetland area will be secured for conservation.

Why is it Happening?

1. Inventories, designations and map notations of wetlands are occurring because governments and non-governmental interests recognize the high value of these ecosystems.

2. Land claims agreements with Yukon and other First Nations often include provisions to create or nominate new SMAs that can protect important wetlands.

Why is it Significant?

Focused inventory work and conservation initiatives ensure that wetlands continue to perform valuable functions that benefit the environment and human populations. These include habitat protection for migratory birds as well as trapping sediments and absorbing pollutants, which helps to maintain water quality.

5.4 Wildlife – Interesting Stories for 2003

In many cases, wildlife surveys are not conducted every year. So, rather than present data that may not offer an update to the comprehensive 2002 State of the Environment Report, this section focuses on an interesting wildlife highlight or event.

5.4.1 Freshwater Fish: Northern Pike Disappear from Watson Lake

Recreational fishing accounts for the majority of Yukon's annual freshwater fish harvest, even though a larger number of resident sport anglers are now releasing more fish than in previous years. Yukon also has commercial, domestic and First Nation food fisheries. The sustainability of these fisheries depends on effective regulation, management tools such as live release, selective lake stocking, and regular sampling of targeted water bodies to monitor fish abundance, among other things.

While governments are responsible for this work, they rely upon community input to identify problems, explain causes and develop solutions. The disappearance of northern pike from Watson Lake in 2003 is a case in point. As the Chief of Fisheries Management for the Environment Yukon later observed, this strange situation lent itself to an investigation that considered historical data, local knowledge and scientific assessment.

In 2002, anglers caught more than 1,500 northern pike from Watson Lake, long renowned for its trophy-sized specimens. Angler harvest surveys and population assessment surveys conducted over that summer confirmed a large, healthy population.

So, local anglers were understandably surprised – and grew increasingly concerned – as the summer of 2003 wore on without the sighting, let alone catching, of a single northern pike at expected times and places. In late July 2003, two days of gillnet sampling for a fisheries assessment yielded the same disturbing result: Not one pike caught or sighted. By the end of summer, nothing had changed. At the same time, all other fish species in Watson Lake were observed in typical numbers and good health.

Unfortunately, cooperative efforts could do little more than confirm the existence and extent of this phenomenon. Analysis of a few dead pike, recovered the previous fall, did not reveal signs of viral infections or other disease, nor did they show any unusual contaminants. The Yukon Government continued to monitor the situation over the winter of 2003. Stakeholders decided to continue monitoring the lake, trusting that pike populations in waters feeding Watson Lake would eventually lead to a natural recovery.

5.4.2 Caribou: The Chisana Caribou Project

In 2003, there was renewed optimism about the fate of the Chisana woodland caribou herd, a genetically distinct population that has experienced a drastic decline – from about 1,800 animals in 1989 to an estimated 360 in 2001. The successful launch of a captive breeding program offered hope that the herd's disappearance by the projected date of 2016 could be prevented.

The depopulation of the Chisana herd was first reported by people who travelled within its range along the Alaska/Yukon border just south of Beaver Creek. Biologists eventually concluded that the cause was poor calf recruitment. For a decade or more, the annual calf survival rate had been less than 10 percent, due primarily to predation from wolves and bears. As a result, the herd's population was ageing; older animals were not being replaced. What no one could explain was why the survival rate had dropped to such levels.

Fortunately, decision-makers recognized the futility of waiting for definitive answers before taking action; the herd could literally be studied to death. While a 1994 ban on licensed hunting and the more recent prohibition of all harvesting under the Yukon *Wildlife Act* addressed one of the factors that may have contributed to the herd's decline, a recovery plan could also tackle a second factor. As an alternative to a controversial predator kill, biologists recommended an innovative captive breeding project that could improve calf survival rates by protecting them from predators during the first three weeks of life when they are most vulnerable. Governments, First Nations, park authorities and academic researchers in both Canada and the United States supported the idea. Their cooperative efforts gave birth to the Chisana Caribou Project.

In March 2003, an eight-hectare fenced enclosure was constructed adjacent to preferred post-calving habitats within the Chisana herd's traditional range. Later that spring, biologists transported 20 pregnant cows to the predator-proof compound, taking careful precautions to limit stress on the animals. Seventeen calves were born and survived until their release and, according to initial surveys, between 10 and 14 were still alive in early August 2003. By comparison, an estimated two of 16 calves born in the wild to radio-collared cows survived to the same date.

Traditional Knowledge –

> *"Outfitter Dave Dickson reported the decline [of the Chisana caribou herd] to Yukon's Fish & Wildlife Branch, and we began to look at the herd more closely. Native people from WRFN and KFN also knew something was wrong with the herd. Over the past two years, biologists from YTG's Fish & Wildlife Branch, WRFN, KFN, Canadian Wildlife Service, Alaska Department of Fish & Game, Wrangell St Elias National Park, the Yukon outfitter and several Alaskan outfitters have been working together to develop a plan to keep the herd from disappearing."*

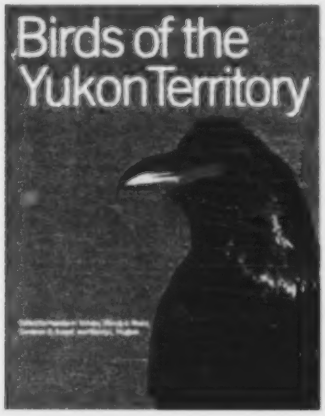
From Overview and Rationale, Chisana Caribou Project Website <http://www.yesnet.yk.ca/schools/stelias/caribou/>.

Given the unqualified initial success of this complex project, plans were made to capture 30 pregnant cows in 2004 and 40 in 2005. Hopefully, continued efforts will lead to a restructured herd composition, population stabilization and a better explanation for the herd's decline. In turn, this should help maintain the long-term functionality of a natural ecosystem that includes a diverse mixture of predators and scavengers, as well as humans.

5.4.3 Birds: A Yukon Bird Book Launch for 2003

In Yukon, annual bird surveys, targeted studies and other bird banding initiatives are carried out annually or occasionally in order to shed light on population dynamics, understand bird behaviour and confirm ranges. While governments and funded academic researchers play important roles in these surveying and monitoring activities, so do many Yukon volunteers. Bird enthusiasts throughout Yukon routinely participate in the annual North American Breeding Bird Survey, the International Migratory Bird Day count, the Christmas Bird Count and the B.C.-Yukon Nocturnal Owl Survey. Many of these volunteers are affiliated with the Yukon Bird Club, which has made a huge contribution through its promotion of "awareness, appreciation, and conservation." The club maintains a website, plans field trips and events, publishes two newsletters each year and offers publications that include a bird watching guide and comprehensive checklist.

When Birds of the Yukon Territory was published through the University of B.C. Press in 2003, Yukon volunteers certainly deserved to feel a sense of pride and accomplishment. More than six years in the making, this almost 600-page book was the result of a project initiated by committed professional and amateur birders. In fact, three of four editors are founding members of the Yukon Bird Club, as well as professional biologists.



Birds of the Yukon Territory contains detailed information on 288 bird species, including facts about distribution, range, nesting and habitat. There are 223 hand-drawn illustrations and 600 photographs that accompany these descriptions. The 10 contributing authors conducted exhaustive research, reviewing the Canadian Wildlife Service's database of over 166,000 historical records dating back to 1861.

Of course, many of these records owe their existence to observations made by enthusiastic amateur bird watchers. The book also benefited visually from the willingness of more than 50 photographers to contribute images.

While Birds of the Yukon Territory appeals to a general audience and especially people with an interest in the natural history of the north, the content is detailed enough to satisfy any bird specialist. The culmination of years of work, the baseline information captured in this weighty yet accessible volume will also help with the future assessment of population, behaviour and habitat trends of birds that are in Yukon year-round or seasonally.

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The Northern Climate ExChange Gap Analysis Project: *An Assessment of Yukon First Nations Traditional and Local Knowledge and Perspectives on the Impact of Climate Change within the Yukon territory and Northern British Columbia* by LegendSeekers, 2000. (Poster http://www.geology.gov.yk.ca/publications/miscellaneous/posters/landslides_poster .pdf>.)

Chapter 2 Air

2.1 City of Whitehorse Air Quality

General:

Standards and Approvals Section, Environmental Programs Branch, Environment Yukon, Yukon Government Contact: Janine Kostelnik, Janine.kostelnik@gov.yk.ca.

Environment Canada's NAPS Network website. <http://www.etc-cte.ec.gc.ca/naps/index_e.html>.

"Let's Clear the Air: about Wood Smoke and Vehicle Exhaust," Environment Yukon, Yukon Government, City of Whitehorse.

Specific:

Figure 2.1.1: Sources: Environment Canada's NAPS Network website <http://www.etc - cte.ec.gc.ca/naps/index_e.html> and draft Whitehorse NAPS 2004 Report, by Janine Kostelnik, Standards and Approvals Section, Environmental Programs Branch, Environment Yukon, Yukon Government.

Chapter 3 Water

3.1 Water Quality Index (WQI) (Indicator under Development)

General:

Mackenzie River Basin Board, Mackenzie River Basin: State of the Aquatic Ecosystem Report 2003 <http://wlapwww.gov.bc.ca/wat/aq_eco_rep/eco_reports.html>.

USGS Yukon River Studies Abstract for 32nd Annual Arctic Workshop March 14-16, 2002.

CCME Water Quality Index website
<http://www.ccme.ca/initiatives/water.html?category_id=42>.

B.C. Water Quality Index websites
<http://wlapwww.gov.bc.ca/wat/wq/BCguidelines/indexreport.html>.

Draft Water Quality Index Peel River Report, Meeting w/City of Whitehorse, EY, consultant.

Consultant report on Peel River Sub-basin.

Chapter 4 Land

4.1 Land Use and Resource Management Planning

Specific:

Figure 4.1.1: Sources:

Regional Land Use Plans (RLUPs)—status map provided by Yukon Land Use Planning Council.

Official Community Plans (OCPs) and Local Area Plans (LAPs)/Area Zoning Regulations—update provided by Community Affairs, Community Development Branch, Department of Community Services, Yukon Government.

Forestry Management Plans—taken from Department of Energy Mines and Resources, Forest Management Branch website <http://www.emr.gov.yk.ca/forestry/>.

Fish & Wildlife Plans—data provided by Fish and Wildlife Branch, Environment Yukon, Yukon Government.

Protected Area Plans—data provided by Parks Branch and Fish and Wildlife Branch, Environment Yukon, Yukon Government.

4.2 Land Use Quality Index (LUQI) (Indicator under Development)

General:

Christie, M., Down the Road: The Effects of Roads and Trails on Wildlife. Yukon Fish and Wildlife Management Board, 2003, 48 pages.

Jalkotzy, M.G., Ross, P.I., Nasserden, M.D., The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Arc Wildlife Services Ltd., May 1997.

Ed. Gucinski, H., Furniss, M.J., Zeimer, R.R., Brookes, M.H., Forest Roads: A Synthesis of Scientific Information. June 2000, United States Department of Agriculture Forest Service.

Environment Yukon, Yukon Government, Yukon Interim State of Environment Report 2001 <http://www.environmentyukon.gov.yk.ca/soe.2001info.html>.

Ministry of Water, Land and Air Protection, Environmental Trends in British Columbia, 2002 <http://wlapwww.gov.bc.ca/soerpt>.

4.3.1 City of Whitehorse Solid Waste Management

General:

Engineering & Environmental Services, City of Whitehorse <http://www.city.whitehorse.yk.ca>.

Education Department, Raven Recycling <http://www.ravenrecycling.org>.

Canada's State of the Environment Infobase <http://www.ec.gc.ca/soer-ree/english/Indicator_series/highlights.cfm#high_pic>.

Environment Canada's Pacific and Yukon Region Environmental Indicators <http://www.ecoinfo.ec.gc.ca/env_ind/indicators_e.cfm>.

Specific:

Figure 4.3.1: Sources: Data provided by Engineering & Environmental Services, City of Whitehorse, and Education Department at Raven Recycling.

Figure 4.3.2: Source: Data provided by Engineering & Environmental Services, City of Whitehorse.

Chapter 5 Nature

5.1 Contaminants in the Environment

General:

Wildlife Management, Fish and Wildlife Branch, Environment Yukon, Yukon Government. <http://www.environmentyukon.gov.yk.ca/fishwild/index.html>. Northern Contaminants Program website <http://www.ainc-inac.gc.ca/ncp/index_e.html>.

Specific:

Kristinsdottir, S.M. Ancient mandibles tell of the industrial revolution. The Yukon News, Page 3, Wednesday, September 8, 2004.

Gamberg, M., Contaminants in Yukon Moose and Caribou - 2003. Unpublished report prepared for Department of Indian and Northern Affairs, Northern Contaminants Program, July 2004, 16 pages.

Gamberg, M., Braune, B., Davey, E., Elkin, B., Hoekstra, P., Kennedy, D., Macdonald, C., Muir, D., Nirwal, A., Wayland, M., Zeeb, B., 2005. Spatial and temporal trends of contaminants in terrestrial biota in the Canadian Arctic. Science of the Total Environment. In Press.

Ryan, M. J., Stern, G.A., Diamond, M., Croft, M.V., Roach, P., Kidd, K. Temporal Trends of Organochlorine Contaminants in Burbot and Lake Trout from Three Selected Yukon Lakes. Science of the Total Environment. In Press.

Traditional Knowledge Box:

Statement prepared by the Aboriginal Partners of the Northern Contaminants Program.

Canadian Arctic Contaminants Assessment Report (CACAR) Phase II report.

5.2 Species at Risk (Indicator under Development)

General:

NatureServe, Fish and Wildlife Branch, Environment Yukon, Yukon Government <http://www.environmentyukon.gov.yk.ca/fishwild/index.html>. NatureServe website <http://www.natureserve.org/index.jsp>.

CESCC Wild Species 2000 Report <http://www.wildspecies.ca/wildspecies2000/en/Report.pdf>.

5.3 Ecosystems: Wetlands

Specific:

Hayes, R.D. A Strategy for Conserving Important Wetlands in the Yukon, 2002-2007. Ducks Unlimited Canada, October 2002, 23 pages.

5.4 Wildlife – Interesting Stories for 2003

5.4.1 Freshwater Fish: Northern Pike Disappear From Watson Lake

General:

Fish and Wildlife Branch, Environment Yukon, Yukon Government <http://www.environmentyukon.gov.yk.ca/fishwild/index.html>.

Specific:

Susan Thompson, Fisheries Biologist, Fisheries Management, Fish and Wildlife Branch, Environment Yukon, Yukon Government.

5.4.2 Caribou: The Chisana Caribou Project

General:

Chisana Caribou website <http://www.yesnet.yk.ca/schools/stelias/caribou/index.html>.

Specific:

Farnell, R., Gardner, C.L., Status Report on the Chisana Caribou Herd—2002 (draft). May 2002, 14 pages.

Personal Communication with R. Farnell, September 2004.

Traditional Knowledge Box:

Overview and Rationale, Chisana Caribou Project Website <http://www.yesnet.yk.ca/schools/stelias/caribou/>.

5.4.3 Birds: A Yukon Bird Book Launch for 2003

General:

Yukon Bird Club Website <http://www.yukonweb.com/community/ybc/>.

Specific:

Eckert, C., Sinclair, P., Nixon, W., Hughes, N. (ed.) Birds of the Yukon Territory. University of British Columbia Press, March 2003, 596 pages.

Eamer, C., Yukon bird book finally hits the shelves. Your Yukon Column, The Yukon News, Column, p19.

Mail-In Evaluation

Your comments on the State of the Environment 2003 Interim Report would be welcome.

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Which indicators did you find most useful?

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Which indicators not included would you like to see included in a future SOE report?

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